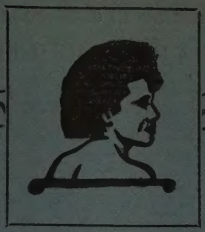
VOL. 18 NO. 3 SEPTEMBER, 1947



COLONY OF FIJI

AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI

PRICE : ONE SHILLING AND SIXPENCE

GOVERNMENT PRESS, SUVA, FIJI

Notes for Libraries and Research Institutes.

FORMER ISSUES OF AGRICULTURAL JOURNAL.

So many requests are received from abroad for parts of the *Agricultural Journal* which were never published that the following list of all issues published and those which are not now available is given for reference. Attention is especially directed to Volume 7 which had only one part:—

Vol.				*Vol.*			
1.	3	numbers,	1928.	10.	4	numbers,	1939 (none of Nos. 2 and 4).
2.	4	,,	1929.				
3.	3	,,	1930 (none).	11.	4	,,	1940 (none).
4.	4	,,	1931.	12.	4	,,	1941 (none of Nos. 1 and 2).
5.	2	,,	1932 (none of No. 2).				
6.	2	,,	1933.	13.	4	,,	1942.
7.	1	,,	1934.	14.	4	,,	1943.
8.	4	,,	1935–37 (none of No. 4).	15.	4	,,	1944.
9.	4	,,	1938 (none of Nos. 2, 3 and 4).	16.	4	,,	1945.
				17.	4	,,	1946 (none of No. 1).

ISSUES OF THE AGRICULTURAL CIRCULAR.

NUMBERS and year of issue of the *Agricultural Circular* :—

Vol.	1,	1920,	12 numbers.	Vol.	4,	1923,	1 number.
	2,	1921,	5 ,,		5,	1924–5,	2 numbers.
	3,	1922,	4 ,,				

As number 4 of Vol. 3 was printed as " Volume 4 " and number 1 of Vol. 4 as " Volume 5 " it would appear from an inspection of a complete set that Volume 4 comprised only a number 4 and that there were two issues of Volume 5, No. 1.

ANNUAL BULLETINS.

THE Annual Bulletin of Divisional Reports ran from 1931 to 1938 and was then discontinued.

OLD ISSUES OF AGRICULTURAL BULLETINS.

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3. Rhinoceros Beetle in Samoa, 1912.
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—EDITOR.

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AGRICULTURAL JOURNAL

ISSUED BY THE

DEPARTMENT OF AGRICULTURE, FIJI

VOL. 18 SEPTEMBER, 1947. NO. 3

EDITORIAL

SOIL CONSERVATION

Although for many years past, the Department of Agriculture has carried out, on its own stations and demonstration farms, various soil conservation practices, these have not been adopted by farmers in the Colony to any appreciable extent. Progress, nevertheless, has been made; and from the small beginnings it is now becoming evident that useful developments are possible. Two aspects may be considered, viz., the conservation of soil by means of soil management and the maintenance of soil fertility by the use of composts and cover crops.

Soil conservation.—That soil erosion in the Colony is serious enough to warrant protective measures has been frequently urged by competent authorities during the past decade. Preventive steps have been taken from time to time by including special conditions in lease contracts and by issuing official propaganda aimed at the prevention of indiscriminate burning and needless destruction of vegetation. These measures have recently been confirmed by an amendment to the Land (Transfer and Registration) Ordinance which makes provision *inter alia* for the inclusion in agricultural leases of covenants or conditions for the protection of land fertility and for the prevention of soil erosion.

Readers will recall that Mr. C. W. Rothe, General Manager of the Colonial Sugar Refining Company, when visiting Fiji recently, commented in an interview on the matter. He said: " . . . I have noticed that many cane-growers fail to plant according to the contour of the land on hillsides as they should to avoid soil erosion. Others are not caring for their stock. This applies more particularly to horses. I am also advised that some do not practise satisfactory rotation of crops and the best use of animal manure, nor is the best use made of home plots for the production of food." It is opportune, therefore, to consider what has been done, however little, and what is planned for the future. Realizing that example is better than precept, the Department has, as stated, engaged in contour farming and has trained a considerable number of Fijian and Indian youths in simple methods of terracing, strip cropping and contour draining. It is encouraging to note that in a number of places the lessons so learned have been put to practical use and small groups of men are growing a variety of crops in the approved way.

Schools have undertaken to contour their hill gardens and good examples are to be seen at Queen Victoria School, Nanukuloa, at Provincial School Northern, Taveuni, and Provincial School Southern, Sawani. With the development of land at the Teachers' Training College and at the Nasinu approved school, attention is being given to soil conservation methods and these will soon become valuable propaganda and demonstration centres.

His Excellency the Acting Governor, Mr. J. F. Nicoll, C.M.G., has always taken an active personal interest in the practical aspects of agricultural development and especially in the prospects of establishing amongst the small land users of the Colony suitable methods of soil and fertility conservation. At his suggestion, fairly exten-

sive work (approximately 200 chains) has been done at the Suva Gaol, at the Tamavua Hospital and at Government House itself. These centres, it is expected, will give a lead to others and plans are now in hand to extend the work to Draiba village and other Government centres.

Further afield, the Extension Staff of the Department has also pushed on with the contouring of farms in a number of localities both in Vanua Levu and Viti Levu. This work is being done as a special extension project and by the end of the year it is anticipated that some 40 small farms will have been dealt with. An unexpected response from farmers in all areas has been met with; and numerous requests are being received for assistance with the preliminary stages of laying out the contours, siting contour drains and silt pits and providing suitable seeds and plants for the purpose. The use of hillside (reversible mouldboard) ploughs is being demonstrated and farmers are taking a keen interest in them. Consideration is being given to the organization of a soil conservation service to meet the increasing demand for assistance and advice.

Composts and Pen Manure.—There is a fairly wide public interest at the present time in the subject of humus and compost: and many gardeners have taken up the making of compost either by the use of an orthodox box or by simpler methods. The application of composts to local farming practice has been studied for some time—cattle pens have been run successfully on Departmental farms—the making of pen manure from farm wastes (vegetable and animal) has been demonstrated and during recent months several farmers in Vanua Levu and Viti Levu have, with some assistance, established similar pens on their own farms. One of these at Bulileka in Labasa has now been working successfully for several months and others are being constructed at various centres—again as a special project of the Departmental extension service. Extracts in the present journal draw attention to recent developments overseas.

Attention has been given to the selection and propagation of suitable legumes such as tropical kudzu, *Centrosema*, *Calopogonium*, and grasses (Guatemala, Elephant, various Blue grasses) which are most suitable for use as cover crops to prevent erosion, as contour hedges to hold the soil and provide fodder or as green manure crops to restore humus and nitrogen to the soil. Seeds and cuttings of all these are being propagated to the full capacity of the areas available to the Department and are being distributed widely throughout the Colony.

These activities comprise a direct and practical assistance to the land-holder which is expanding daily and which, provided it is followed up and adequately maintained, should result in a steadily increasing influence on the attitude of local farmers to the source of their well being—the soil.

—B.E.V.P.

OVERSEAS VISITORS

Dr. A. C. Smith, Botanist of the Arnold Arboretum, University of Harvard, who arrived in the Colony in May, has spent several months investigating the vegetation of the Mt. Evans and the Nadarivatu–Nadrau regions in north-western and central Viti Levu. He has moved to Vanua Levu to complete his collections of specimens in less well-known districts. Dr. Smith is a leading authority on the Fiji flora and has already published several important bulletins on the subject. He expects to remain in Fiji until February 1948.

Professor J. T. Buchholz from Illinois University, U.S.A., who is a world authority on the botany of coniferous trees, passed through Fiji during September on his way to New Caledonia where he is making an intensive study of the island's genera (*Podocarpus*, *Agathis*, *Acmopyle*, etc.). He spent most of his limited time in Fiji studying the available material in the Department's herbarium and living specimens of the genera *Agathis*, *Podocarpus* and *Dacrydium* in the arboretum at Naduruloulou.

—B.E.V.P.

A REPORT ON A TOUR OF COASTAL QUEENSLAND AND THE TWEED RIVER OF THE FAR NORTH COAST OF N.S.W.

BY R. N. SANDERS, B.V.Sc., ANIMAL HUSBANDRY OFFICER

[The following is a summary of the report and recommendations submitted to the Director of Agriculture by the Animal Husbandry Officer as the result of a tour undertaken during his vacation leave in Australia. In the course of his tour which occupied 33 days, Mr. Sanders covered over 4,000 miles by rail and car and interviewed a large number of farmers and officers of the Commonwealth and State Departments.—ED.]

A.—INTRODUCTION.

A common feature of tropical agriculture is the deterioration of livestock resulting in lowered production. Under the terms of the Paterson and Dodds Report the Department of Agriculture is required to extend its work on animal husbandry, including the investigation of local problems and the establishment of stud herds and flocks under the general direction of the Animal Husbandry Officer. There has been conflict of opinion amongst both farmers and officers of the Department of Agriculture as to which breeds should be imported and it was arranged that the Animal Husbandry Officer should visit Queensland and northern New South Wales to report on experience with various breeds of livestock under tropical and sub-tropical conditions in the Commonwealth and also to observe animal nutrition problems.

The tour involved 4,133 miles of travel by rail and car over a period of 33 days. Although much of the dairying undertaken in Queensland is located in areas with an elevation of over 2,000 ft. above sea level, visits were with few exceptions limited to the coastal areas where climatic conditions are, in the main, comparable with those in Fiji.

B.—DAIRYING.

Breeds.—In the Queensland highlands the Australian Illawarra Shorthorn breed accounts for 80 per cent of all dairy cattle, Jerseys 10 per cent and all others (including Ayrshire and Friesian) 10 per cent. In the coastal districts Jerseys account for 60 per cent and Illawarra Shorthorns 40 per cent. In the northern New South Wales coastal districts Jerseys predominate with 75 per cent, Shorthorns 20 per cent, Guernseys, Friesians, etc., five per cent.

The consensus of opinion amongst successful farmers is that under tropical conditions the Jersey and Illawarra Shorthorns are the only European breeds worthy of consideration for either butterfat or milk production. The latter breed was probably the better producer under lower than optimum conditions of nutrition, but neither was completely satisfactory.

Research is being directed towards the introduction of Zebu blood to European breeds with the aim of evolving a type which would be physiologically better able to withstand tropical conditions. The Animal Geneticist of the Council for Scientific and Industrial Research (Dr. R. B. Kelley) expressed the opinion that no European breed, as a whole, was better suited than any other to tropical conditions, but that for butter-fat production the Jersey was the logical cross with the Zebu. The significance of breed was, however, limited to general characteristics, e.g. Jerseys or Guernseys for butter-fat, Friesians for milk, but the strain within the breed was much more important when selecting for productive capacity. No breed weakness of Jerseys for tuberculosis was known, and no farmers had observed any susceptibility.

Production and Breeding.—The following is the average production of butter-fat per cow per annum for the 1944–45 season in Queensland and New South Wales as compared with Victoria and with New Zealand.

Queensland	111·3 lb
New South Wales ..	123·5 lb
Victoria	143·3 lb
New Zealand	279·6 lb

The low Queensland average reflects the adverse climatic conditions under which dairying is carried on, coupled with the

failure of a large number of farmers either to adopt herd testing as a measure of productivity or to practice pasture and fodder improvement and conservation to offset droughts. Concentrates have been in very uncertain supply and also bulky forage, so that farmers dependent on outside sources of supply during adverse seasons have been very badly off for stock feed. Pastures consist mostly of native spear grasses with areas of Rhodes grass, Para, seed grass, "Blady" grass[1] sensitive plant, Guinea grass, molasses grass, *Paspalum*[2] Kikuya, and "Stylo". On many farms the pastures were eaten out because of the practice of stocking up to wet season capacity, depending on purchased fodder and concentrates for the lean months. Ruling prices (Australian currency) for concentrates were: peanut meal £12 a ton, molasses 22s. per 44 gallons, maize meal £11 10s. 0d. a ton, bran £10 a ton, meat meal £13 a ton, wheaten chaff cost £17 15s. 0d. a ton. Butter-fat returns 1s. 3d. per lb. and milk 1s. 7½d. a gallon.

Monthly gross return per cow varied from £1 on the poorer farms to £4 on well-managed farms, and average butter-fat production per cow on commercial farms varied from 116·4 lb per annum to 363·5 lb. Measures taken by successful farmers to maintain production at economic cost included one or more of the following: limitation of rate of stocking below the maximum possible during the wet season, i.e. conservation of pasture; rotational grazing; planting of fodder crops, principally maize, saccaline, and occasionally lucerne, either for direct feeding or (preferably) for ensiling; the use of portable pumps for the irrigation of fodder plots and of pasture flats.

Milking machines are coming into general use, despite previous strong opposition by farmers; even under tropical conditions no trouble is experienced if cleansing is properly carried out.

A few farms had covered cow yards under which cows wait to enter the bails for milking. Their use is stated to increase yield and to reduce considerably the bacterial count of the milk in wet weather.

C.—Beef Cattle.

The European breeds were generally in good condition wherever improved pasture, such as Guinea grass, was available. Farmers engaged in the production of stores (as opposed to those engaged in fattening) were generally in favour of the Zebu crosses for poor grazing country on which pasture improvement was impracticable. During severe drought it was observed that store cattle with Zebu blood survived and even maintained store condition where the pure European breeds died of starvation.

On fattening properties improved pastures on second rate land were fattening a beast to two acres in nine to 10 months, producing a two to three year old killing out at 600 lb average. (This is half the time it takes to fatten in Fiji.)

D.—Pastures and Fodder.

In general, the state of pastures and neglect of fodder conservation indicated no advance on conditions in Fiji, but very much more investigation had been carried out and this, together with the experience of many progressive farmers, is of great potential value to Fiji.

Grasses.

(*a*) "*Scrobic*[3]".—This South African variety promises extremely well in Queensland at about the 30 inch rainfall level. It is a fast summer grower which dries off to a standing hay of good nutritive value with succulent fodder at the base. It does best on a slightly acid soil. It may be suited to the Fiji dry zones.

(*b*) *Guinea grass*[4].—Several types are under trial. When properly managed it seems the best of the high rainfall grasses.

(*c*) *Red Guinea grass*[5].—This was superior to any other Guinea grass. It is deep rooted and does not form coarse tussocks; it is succulent down to soil level and for this reason and because of its palatability to stock it must be carefully grazed.

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1 *Imperata cylindrica.*
2 *P. dilatatum* Poir.
3 *Paspalum scrobiculatum* Linn.
4 *Panicum maximum* Jacq.
5 *P. maximum* var. *coloratum.*

(*d*) *Molasses grass*[1].—This has been very popular in Queensland, but its drawbacks are the ease with which it burns, even when green, and its tendency to dry off. It does not have the carrying capacity of Guinea grass.

(*e*) *Para grass*[2].—Little of this grass was seen in Queensland: most of the country suitable for Para grass is under sugar cane, and progressive graziers prefer Guinea and molasses grasses which stand up to dry weather better.

(*f*) *Other Brachiaria species*[3]: are under observation.

(*h*) *South African Star Grass or Kenya Couch*[4].—This was regarded as being the best dry season grass, and is sometimes grown in mixture with molassses or Guinea grasses. There is some uncertaintly as to the danger to stock of prussic acid poisoning from grazing this grass.

(*i*) *Two species of grasses*[5] are under trial. At Gatton College one of these made excellent growth under dry conditions; it dries off rapidly but is said to make excellent hay.

(*j*) *Other grasses.*—Blue panic grass[6] is reported a good grass for wet and dry conditions but forms tussocks, Woolly Finger grass[7] has proved hardy in North Queensland but is not relished by stock. Four other grasses[8] are doing well; however Rhodes grass[9] is falling out of favour.

FODDER PLANTS.

(*a*) *Kudzu*[10].—This true Kudzu under trial at the Bureau of Tropical Agriculture gave similar unsatisfactory results to those obtained in Fiji. Tropical kudzu or Puero[11] is much more promising. It is not yet fully accepted by graziers. It appears under trial to be more palatable than "Calopo", "Stylo" or "Centro" in pure stand.

(*b*) "*Stylo*"[12] gives good growth under Queensland coastal conditions but is not very palatable when grazed to stock; it will be eaten after it has matured, and when mixed with Guinea grass, but is not relished. Townsville lucerne[13] has lost much of its former popularity though it makes excellent hay.

(*c*) "*Calopo*"[14] has also been disappointing and is apparently not relished by stock.

(*d*) "*Centro*"[15] is so far the best legume under trial. It forms an excellent and nutritious cover the whole year round, and is relished by stock. In mixture with Red Guinea grass it may be eaten to the ground if not protected; the Guinea grass provides cover for the "Centro" under grazing conditions.

(*e*) *Pigeon pea*[16] is an excellent green manure crop and has yielded up to 1,000 lb per acre of dried peas, but the foliage is found to be unpalatable to stock.

(*f*) *Other legumes.*—Phaseolus[17] showed great promise but is not relished by stock. Desmodium, Rhodesian Kudzu vine, Butterfly pea and Dolichos[17] are under trial and show promise.

(*g*) *Grain sorghums.*—The grain sorghum "Milo" and "Kilo" have come into great popularity throughout Queensland during the war, and provided an excellent substitute for wheat and wheat offals for poultry and pigs. Extensive areas have been planted in the 20–30 inch rainfall areas with yields of 50–80 bushels per acre of grain. Actually both will grow well wherever maize will grow but on the wet coastal areas of Queensland a great deal of trouble has been experienced with mildew and peach moth. A new open-headed variety has now been produced to eliminate this trouble, which may be avoided by planting in the dry season.

It has been shown that when machine-harvested, Milo can be produced cheaper than maize. Milo has approximately the

---

1 *Melinis minutiflora* Beauv.
2 *Brachiaria mutica* (Forsk) Staff.
3 *B. brizantha, B. subquadruparia, B. decumbens.*
4 *Cynodon plectostachyum* Pilger.
5 *Urochloa panicoides* Beauv., *U. buldoibes.*
6 *Panicum antidotale* Retz.
7 *Digitaria melangiana.*
8 *Panicum makrikariensis, Andropogan gayanut, Setaria aurea, Hyparrhenia hirta.*
9 *Chloris gayana* Kunth.
10 *Pueraria thunbergiana* Benth.
11 *P. phaseoloides* Benth.
12 *Stylosanthes guianensis* Sw.
13 *S. sundaica* Taub.
14 *Calopogonium mucunoides* Desv.
15 *Centrosema pubescens* Benth.
16 *Cajanus cajan* (Linn) Millsp.
17 *Phaseolus lathryoides* (Linn).

same food value as maize except that it is lower in Vitamin A. It has a higher protein and mineral content than maize but a lower fat content. As there is a general lack of protein in local concentrates (except coconut meal) fed in Fiji, as well as a high fat content, the grain sorghums should be a welcome addition to local products. These could also replace the importations of wheat and wheat offals which are costly and in irregular supply.

Japanese millet forms an excellent quick growing green fodder crop in the 80–90 inch rainfall zone, where it is used extensively in association with dairying.

PASTURE MANAGEMENT.

A feature of the best farms was the way in which Guinea grass was maintained in productive condition by keeping down to a height of only six to eight inches by careful rotational grazing with, in the wet season mowing to keep it from getting away from the stock. Although Para grass was good in the wet season it could not compare with well-managed Guinea grass during dry spells. The carrying capacity ranged from one to two acres per beast for fattening.

On hill lands, Guinea grass and Centro was the best mixture, standing up better to dry weather grazing than Guinea and Puero.

Even under 80 inches rainfall, pastures were being irrigated, using portable pumping outfits costing about £250 with piping.

CONSERVATION OF FODDER.

The general practice on too many farms is to stock up to wet season capacity with the result of over-stocking in the dry season and consequent damage to pastures and loss of stock unless purchased bulk feed and concentrates can be brought in. The best farmers maintained adequate nutrition by stocking only to average capacity (mowing if necessary to control fast growth in the wet season), by the proper rotation of grazing, by the irrigation of pastures where possible, by the growing of forage crops (usually maize) and by the use of silos.

E.—POULTRY.

Breeds.—White Leghorn and Australorp are the most popular breeds, with Rhode Island Reds far behind. Where there was a demand for table birds the Australorp is preferred. Losses from disease, however, are far heavier in the case of Australorp than with other breeds. From the point of view of production there is little to choose between breeds; Australorps are best on the first year's production. The average annual production of eggs per bird in Queensland is 160 on the better farms; the best Australorp and the best White Leghorn under test at Gatton College laid 310 and 279 eggs respectively in 365 days.

Feeding.—Grain sorghum is being used in place of wheat. Birds do not at first relish grain sorghum but become accustomed to it. Many farmers feed a dry mash in hoppers to reduce labour costs, and this appears to have no adverse effect on production.

Management.—The intensive house is generally considered too hot for the tropics but they are widely used in Queensland, the design of the house being modified to increase ventilation. The comparatively high initial cost is offset by reductions in land required, losses from internal parasites, rats, etc., food and labour, and by increased production; increases of 10 to 12 eggs per bird per annum are claimed. Only four square feet of land per bird are required as compared with 175 square feet under range. By raising chickens on concrete and transferring to intensive houses losses from internal parasites due to soil contamination are negligible: in Fiji losses from this cause may be as high as 50 per cent. The ration must be properly balanced if the birds have no free range.

On well managed farms the birds of the heavier breeds are disposed of after the first year's laying.

Hatching between mid-August and mid-September is found to be advantageous; pullets hatched earlier than this go into a heavy moult. The feeding of Vitamin A concentrate appeared on one farm to be responsible for an increase in hatching percentage from 35 to 75 per cent, though this may have been influenced by the low fertility of cockerels during the moulting season. Heated brooders are used even as far north as Cairns.

F.—PIGS.

As most attention was given to other forms of livestock, a thorough study of pig raising was not possible.

The Large White and Tamworth breeds are favoured, as bacon production is the chief interest. Grain sorghums are being used to replace wheat. A special farrowing pen seen at Gatton College is claimed to eliminate losses due to crushing; an average of nine reared to 10 piglets born is recorded.

G.—DISCUSSION AND RECOMMENDATIONS.

Dairying is the most important animal industry in Fiji; besides the production of factory butter and ghee, and of whole milk, which includes milk and ghee production by thousands of small farmers, mostly Indians. The total of farm ghee and milk for home consumption probably exceeds in quantity the butterfat sold to factories and milk supplied to townships. Local consumption has greatly increased while production appears to have declined: in 1945 Fiji imported 271,259 lb of ghee and 69,853 lb of butter, more than in 1940 when 2,288 lb butter were actually exported while milk supplies to townships are generally inadequate. Farmers complain of decreased yields, particularly in the low rainfall districts.

In the Atherton Tablelands in Queensland, over a period of 20 years, the average annual production of butterfat per cow has declined from 300 lb to 120 lb, despite the introduction of improved stock; this decline has been associated with the gradual deterioration of pastures. Deterioration of local (Fiji) pastures has occurred; while war conditions (shortage of labour) are partly to blame, for this, they have probably only hastened and accentuated a natural decline in productivity. Apart from this, Fiji pastures could never be considered good. As well as a general lack of protein there is a wet season of lush growth followed by a dry season of little or no growth accentuated by occasional droughts. A dairy industry cannot thrive with such irregular fodder supplies.

Hammond has stated "Under natural conditions wild animals are at the mercy of environmental conditions and in most places have abundant nutrition at one time of the year and little at another. Very much the same conditions exist in the domestic animals of primitive peoples and under some range conditions to-day. With the modern development of agriculture however, conservation of fodder has made it possible to breed and select for early maturity in our domestic animals, which it would have been impossible to do under the natural conditions of intermittent food supplies." Hammond is referring to beef and mutton, but the same principle applies to the production of milk and butterfat. On even the best properties in Fiji livestock are " . . under the natural conditions of intermittent food supplies " and production cannot be improved, no matter how high the breeding of the animals, until the level of nutrition is raised. Progressive farmers in Queensland have proved, under very similar conditions, not only that these seasonal differences can be levelled out but that it is profitable to do so. Why was it that in Queensland the net returns from ordinary grade cattle so often exceeded those from highly bred cattle under similar climatic conditions? The answer was always—improved nutrition; the successful man had achieved " . . . control of environmental conditions . . ." and this can be done in Fiji.

The Fiji Department of Agriculture should undertake work along the lines described, viz.:

(i) the comparison of the productive capacity of natural and improved pastures, the latter to include:—

- (*a*) established grasses in common use such as Para, Guinea and Nadi Blue grass under controlled stocking and rotational management;
- (*b*) mixtures of the above grasses with various legumes, e.g. Centro, Stylo and Puero;
- (*c*) new grasses such as Red Guinea grass, Scrobic;
- (*d*) mixtures of these grasses with legumes;
- (*e*) top dressings of compost, liquid manure, inorganic fertilizers (superphosphate, coral sand, etc.);

(ii) The economic use of:—

(*a*) local concentrates: coconut meal, molasses, rice bran, maize, etc.,

(*b*) new concentrates: grain sorghums, candlenut meal, etc.

(iii) The growing and use of elephant grass, sorghums, Japanese millet, etc., as fodders.

(iv) The conservation of fodder as ensilage or hay.

(v) The irrigation of pastures where applicable.

The cost of such a programme, and the time required to carry it through, could be reduced by following the work carried out in Queensland and trying out the most promising lines under the intermediate climatic zone conditions of Fiji, with extension therefrom to the more extreme dry and wet zones.

All such work must have cost as a major consideration, since increased production at high cost would obviously be uneconomic. Moreover with peasant farmers no progress will be made without better control (tenure) of the land on which the stock graze. Earlier results from the demonstration of improved practices would be more likely with the organized suppliers of milk and butterfat.

It has been recommended that the Department should import pedigree stock for the improvement of local herds. This would be a waste of money if the level of nutrition is not first raised. To quote Hammond again "Efforts to improve the breed and conformation without first arranging for a better food supply will be of little avail". At best Fiji can only hope to import high producing capabilities, and these capabilities cannot be realised in the imported stock or their progeny unless an environment can be created similar to that from which they originated. The importation of highly bred stock will not, by itself, bring about a rapid improvement in local production. Unless a high level of nutrition is achieved and maintained such stock can revert in one generation to the common "bush" type, no better and perhaps even worse than local stock.

In New Zealand, where feeding practice has always been in advance of Fiji, the average annual production of butterfat per cow has increased by 61 lb over a period of 20 years. The New Zealand Dairy Board analysed the causal factors and in the Board's Annual Report for 1943 the following table is given:—

CAUSE OF INCREASED PRODUCTION PER COW (1923–43).

Factor responsible.	Estimated share of improvement (lb butterfat).	Percentage of total.
Selection of daughters from highest producing dams	·2	3·3
Culling of low producers	8	13·1
Change of breed and grading up through use of pedigree sires	16	26·2
Improved feeding	35	57·4
Total increase (20 years)	61	100·0

Thus improved nutrition (57·4 per cent) had more than double the effect of improved breeding (26·2 per cent). Moreover the effect of improved breeding would not have been possible in the absence of improved nutrition.

The Department should not, therefore, import pedigree stock until the plane of nutrition has been raised at least on the agricultural stations. Moreover, there has been a tendency for breeders to devote too much attention to the winning of show-ring prizes on points of beauty. Fiji importers should insist on "proven" stock, those of high-producing ancestry which are high producers themselves and which have proved their ability to transmit this factor.

When the time comes for the Department to import stock it is recommended that two dairy breeds only should be considered, the Australian Illawarra Shorthorn and the Jersey, which have proved themselves in Queensland. The Jersey has a bad reputation in Fiji where this breed is said to be more susceptible to tuberculosis. There is no record in literature of a breed weakness for this disease and it is considered that the Jersey's reputation in Fiji has suffered from a series of coincidences.

Experience in Queensland, Jamaica, and other tropical countries indicates that local selection of stock, with the retention of a proportion of Zebu blood, will play an important part in any local breeding programme. The Zebu is physiologically better suited to tropical conditions than the European breeds; however the Fiji peasant farmer usually has too high a concentration of Zebu blood in his livestock, with the result of low milk production, while the commercial dairy farmer may need the introduction of Zebu blood to his herd to give his stock better climatic adjustment. For the average small farmer, who will be slow to adopt practices for the improvement of livestock nutrition, the Zebu cross with its proven ability to stand up to vigorous conditions, offers the best solution.

Other tropical countries have already started breeding and selection work with Zebu cross cattle for milk production. In some of these countries progress is likely to be slow, but in Fiji, the Zebu introduction is long established and in the writer's opinion a more or less genetically standardised milking type of Zebu cross has already been established. The Department should accordingly maintain a small herd of Zebu cross bred cattle and demonstrate what level of production can be achieved with proper feeding.

Herd testing shows the farmer just what his production is and enables him to compute the value of improved breeding and feeding. In New Zealand most farmers were at one time against herd testing, but they have come to appreciate its value and now most of them insist on it. Herd improvement and increased production cannot be fully achieved without herd testing, which also encourages a competitive urge amongst farmers. Consideration should be given to requiring participation in a herd testing scheme a condition of the registration of a dairy.

Eggs and poultry form an important part of diet for almost 50 per cent of the people of the Colony which is forbidden beef on religious grounds. Eggs are comparatively expensive and scarce for a large part of the year; poultry is also expensive. This is due to the heavy losses experienced by local poultry farmers together with malnutrition if imported foods are not used and prohibitive expense when they are. Experience in North Queensland reveals that, with proper housing and management, disease losses are greatly reduced and individual production is increased. In Queensland the grain sorghums, which should grow readily in Fiji, can replace wheat and wheat offals in the diet.

It is recommended that the Queensland method of housing and management, including feeding, be demonstrated on Departmental stations. It is also recommended that selection for strains of birds that thrive under local conditions be carried out.

MILDEW OF ZINNIAS

Powdery mildew of *Zinnias* which is very prevalent in local gardens can be controlled completely by spraying with Bordeaux Mixture before blossoming and again three weeks later, taking care not to spray any open flowers. For details consult *Gardening Notes* obtainable from the Librarian, Department of Agriculture; cost 1s.

RAT CONTROL

A bait recommended by the Ministry of Agriculture is as follows:—

Ordinary "National" flour ..	90 lb
White sugar	10 lb
Zinc phosphide	5 lb

[Extract from "The East African Agricultural Journal of Kenya, Tanganyika, Uganda and Zanzibar." Vol. XII, No. 3 dated January 1947, page 183.]

AGRICULTURAL NOTES

1. NOXIOUS WEEDS (AMENDMENT) REGULATIONS 1947

Regulations gazetted on 26th September, 1947, have the effect of extending both the list of Noxious Weeds in the Colony and the areas in which measures must be taken against them by the occupiers of land.

The weeds are grouped in two Schedules and may be referred to for the sake of convenience as primary and secondary noxious weeds.

In the case of the primary weeds it is an offence under the regulations to allow any of those named to grow on land within the areas specified in the tabulated statement below. The occupier is obliged to keep his land entirely free from these primary weeds without waiting for the direction of an Inspector.

The secondary weeds are those against which measures must be taken by the owner or occupier in accordance with a notice by the Director of Agriculture.

Some weeds appear in both Schedules, since their status varies in different Provinces. It is obviously desirable to keep certain districts free of the weeds which heavily infest other areas, hence their proclamation as primary weeds in those provinces still comparatively free of them, while in heavily infested areas, where total eradication is impracticable, it may be necessary to direct specified control measures in some situations.

The following lists show the status of the noxious weeds in the Colony as a whole and in the various Provinces of Viti Levu:—

PRIMARY WEEDS.

The whole Colony.

Giant sensitive plant.
Prickly pear.

Vanua Levu, Taveuni, Kadavu.

Ellington curse.
Tobacco weed (except Taveuni).
Solanum.
Noogoora burr.
Johnson grass (except Labasa).

Vanua Levu (except Labasa).

Muraina grass.

Viti Levu.

Rewa—
Ellington Curse.
Johnson grass.
Noogora burr.

Naitasiri—
Ellington Curse.
Johnson grass.
Noogoora burr.

Namosi—
Ellington Curse.
Johnson grass.
Noogoora burr.

Serua—
Ellington Curse.
Johnson grass.
Noogoora burr.
Muraina grass.

Nadroga and Navosa—
Ellington Curse.
Johnson grass.

Ba—
Ellington Curse.
Tobacco weed.

Ra—
Johnson grass.
Muraina grass (except Raviravi, Rakiraki, Naroko, Navolau).

Tailevu—
Ellington Curse.
Johnson grass.
Noogoora burr.

SECONDARY WEEDS.

The whole Colony.

Water hyacinth.

Vanua Levu, Taveuni, Kadavu.

Broom weed (*Sida acuta*).
Johnson grass (Labasa only).

Viti Levu.

Rewa—
Kosters curse.
Tobacco weed.
Mint weed.
Solanum.
Hibiscus burr.
Broom weed*.

Naitasiri—
Kosters curse.
Tobacco weed.
Mint weed.
Solanum.
Hibiscus burr.
Broom weed*.

Namosi—
Broom weed*.

Serua—
Kosters curse.
Tobacco weed.
Mint weed.
Solanum.
Hibiscus burr.
Broom weed*.

Nadroga and Navosa—
Kosters curse.
Tobacco weed.
Mint weed.
Solanum.
Hibiscus burr.
Broom weed*.
Noogoora burr.

Ba—
Johnson grass.
Noogoora burr.

Ra—
Ellington curse.
Noogoora burr.
Broom weed*.

Tailevu—
Kosters curse.
Tobacco weed.
Mint weed.
Solanum.
Hibiscus burr.
Broom weed*

* Broom weed—Sida acuta.

—A.D.M.

2. WOODEN OIL MILLS IN FIJI

Since the rise in price of copra, it has become a problem to buy sufficient coconuts for making oils for home consumption. In substitution for coconut oil, peanut oil, sesamum (Til) and mustard oils are the best; and to extract oils from these, oil mills are required. Oil makers of India who belong to the trade known as "Teli" have made wooden mills for oil extraction. These mills are called "Kohlu".

At present there are four wooden oil mills in Viti Levu and all in the Nadi district, two at Votualevu and two in the Sabeto Valley. The working capacity of these mills for an eight hour day, is two gallons of oil, either of mustard, sesamum or peanuts.

The mill is operated by a horse which goes round and round harnessed to a weighted beam. This beam is attached at right angles to a wooden shaft which fits inside a hollowed out tree-trunk set upright in the ground, the whole working on the principle of the pestle and mortar. From the bottom of the cavity in the trunk a small hole is bored to the outside, to drain off the oil as it is expressed from the seed. The seed is placed inside the hollow in the trunk and the horse set in motion. The pestle, as it rotates, crushes the seeds between it and the trunk, and the oil runs down to the drain hole at the bottom and so into the container outside. This is of course a primitive method, the mill being made out of Vesi wood obtained from the back of Nadi hills. The hollowing out of the trunk and shaping of the pestle and the whole construction takes four or five days before the mill is ready to operate.

The millers in the Nadi district charge at the rate of 5s. per kerosene tin full (approx. half a bushel) of either peanuts, mustard or sesamum grains to extract the oil. These oils are extracted essentially for home consumption by the growers; but small quantities, surplus to the requirements of the home find a very ready market in Nadi Town. Farmers in the environs of these small mills bring in their grains for crushing, as the nearest mill is at Varoka, Ba. This mill is of a large mechanical type, quite unsuitable for handling the small quantities of oil seeds that the peasant farmer wishes crushed at one time.

The selling price of oils extracted from these mills is as follows:—

Peanut oil .. 4s. per 26oz. bottle.
Mustard oil .. 5s. ,,
Sesamum oil .. 5s. ,,

This primitive system of extracting oils is becoming increasingly popular, as it can be seen that the number has reached four, whereas five years ago there were none. Another mill of this type is about to be erected at Toga in the Nadroga Province and will serve the whole of the Sigatoka River Valley where considerable quantities of peanuts are grown each year. This season for the first time a large area has been planted in mustard (20 acres in the Sigatoka River Valley alone), and it is understood that the bulk of it will be used for oil extraction as difficulty exists in procuring mustard oil which is in great demand.

These mills are serving a very useful purpose and have relieved the situation when there has been great difficulty in procuring oils for home consumption. The by-product is used for cattle and poultry feed. It is rich in nitrogen and would be suitable for fertilizers.

Teli—caste of oil makers in India.
Kohlu—wooden mills. —S. RAMJAN.

3. JUVENILE FARM CLUBS

During 1945 Departmental Officers were instrumental in the formation and organization of juvenile farm clubs at Kavanagasau School, Nadroga and Korotari, Vanua Levu

By the end of 1946, 12 clubs, all associated with country schools, were in action and Field Officers received many requests for advice and assistance. Arrangements were made for the issue of plant material and livestock as prizes for competitions held by the members of these clubs and demonstrations and lectures were given in a range of subjects.

In January 1947, it was decided that, as all existing clubs were comprised of school children attending school, the control and organization of these clubs should be taken over by the Education Department. Up to date the Director of Education has reported the establishment of 48 clubs in schools throughout the Colony. Several successful competitive shows and demonstrations have been held and the movement appears to be flourishing.

—B.E.V.P.

4. RICE PRODUCTION 1946-47

The following is a table of rice plantings for the 1946–47 season:—

Area.	Transplanted. (acres.)			Drilled. (acres.)			Broadcasted. (acres.)			Total planted
	Indian.	Fijian.	Others.	Indian.	Fijian.	Others.	Indian.	Fijian.	Others.	All races.
Southern Division[1]—										
Canegrowers	2,104	...	...	410	...	...	597	...	...	3,111
Others	2,077	153	1	163	5	6	67	...	2	2,474
Total ..	4,181	153	1	573	5	6	664	...	2	5,585
Western Division[2]—										
Canegrowers	1,978	...	...	850	...	...	3,615	...	...	6,443
Others	2,212	200	8	1,274	154	9	3,487	258	5	7,607
Total ..	4,190	200	8	2,124	154	9	7,102	258	5	14,050
Northern Division[3]—										
Canegrowers	980	...	...	114	...	...	1,177	...	...	2,271
Others	2,612	...	...	168	...	...	761	...	...	3,541
Total ..	3,592	...	...	282	...	...	1,938	...	...	5,812
Fiji Total	11,963	353	9	2,979	159	15	9,704	258	7	26,447

[1] Provinces of Tailevu, Naitasiri, Rewa and Serua.
[2] Provinces of Ra, Ba, Nadroga–Navosa.
[3] Provinces of Macuata, Bua and Cakaudrove. —B.E.V.P.

ANIMAL HUSBANDRY NOTES: NUTRITION SERIES

1. THE INADEQUACY OF THE PARA GRASS-COCONUT MEAL MIXTURE FOR DAIRY PRODUCTION

BY R. N. SANDERS, B.V.Sc., ANIMAL HUSBANDRY OFFICER

[The following is the first of a series of articles on the nutrition of livestock contributed by the Animal Husbandry Officer. It deals with the subject of the adequacy of grass fodders alone (whether composed of Para or any other grass), which, on the theoretical bases of chemical analysis and calculation, do not provide the optimum nutritive ratio and which are not therefore satisfactory for optimum production.

Farmer readers will be aware, and it may be argued that, with average production of milk per cow in Fiji only one gallon per day, there is still much that can be done in the way of grass improvement and management before the universal feeding of concentrates becomes necessary. This was recently illustrated by a case at Navua where a herd of 46 dairy cows were moved temporarily from a farm of 139 acres to enable the denuded pastures to be rehabilitated. During the temporary period, the cows were provided with supplementary feed (molasses, coconut meal, rice bran) with the result that the production per cow rose from 165 lb to 192 lb. On their being returned to the renovated (Para) pastures the production rose to 226 lb without supplementary feed and it was found possible to increase the number of cows milked to an average of 60.

The article does, however, stress the inadequacy of a purely grass diet for maximum production and promises a solution of that problem.—ED.]

An increasing number of dairy cattle owners in Fiji realise the inadequacy of Para grass alone and, in order to correct this deficiency, feed coconut meal. Not all dairy farmers appreciate the fact that even coconut meal added to a Para grass ration can be inadequate for milking stock.

All animals require carbohydrates, proteins, fats, minerals and vitamins to maintain the normal body functions of digestion circulation and respiration as well as growth and locomotion. The foods necessary to maintain these functions are termed "maintenance requirements". As milk is a rich food in itself and is produced by the body, the milking cow requires carbohydrates, and proteins in addition to the "maintenance requirements". These additional foods required for production are termed "production requirements".

For the sake of convenience nutrition workers group the heat or energy-producting ingredients of a food together under various terms. The common British term for such ingredients is the "Starch Equivalent". It will be appreciated that though a food may have a certain chemical analysis not all of the chemical ingredients will be available to the animal eating it. Some will be lost in the fæces. Also certain coarse foods such as grass will require more energy in mastication than say coconut meal. It has been proved elsewhere that only 47 per cent of the available carbohydrates of Para grass hay is actually absorbed by a cow. On chemical analysis, Para grass hay has 44·5 per cent carbohydrate but only 20·9 per cent (or 47 per cent of the total) is actually absorbed by the cow. On the other hand 87 per cent of the available carbohydrate of coconut meal can be used by a cow. Not only has coconut meal more carbohydrate; but more of it can be utilised than in Para grass hay. The Starch Equivalent of a foodstuff is therefore the amount of nett digestible energy-producing ingredients as compared with the amount of energy that can be produced by one pound of pure starch.

The protein and crude proteins of a foodstuff are the flesh and milk producing ingredients. The Protein Equivalent of a fodder is the net amount of digestible flesh-producing ingredients that can actually be utilised by an animal.

It will be appreciated that different foods have varying amounts of ingredients. It is

known that when the amount of energy-producing ingredients is high in relation to the flesh-producing ones, the latter cannot be utilised as well by the animal. Thus not only is it essential to have certain quantities of the ingredients but those ingredients must be in the correct proportion. This relationship is termed the "nutritive ratio." The nutritive ratio is said to be wide when there is a large amount of energy-producing units to flesh-producing ones, but when the quantities of both types are almost equal the ratio is a narrow one.

Fattening and idle stock can do well on a wide nutrition ratio of 1 : 8 to 1 : 15; but young and heavy milking stock need a nutritive ratio of under 1 : 6. Low peoducing cows do not need as narrow nutritive ratio as high producing ones. A 900 pound cow producing 1 gallon of 3·5 per cent test milk per day requires a nutritive ratio of not more than 1 : 8 ¢ 7. If this cow produced two gallons of milk daily the nutritive ratio would have to be under 1 : 7 ¢ 8 and when four gallons under 1 : 6 ¢ 9. Actually it is a good rule when feeding milking cows to keep the nutritive ratio as close to 1 : 5 as the economics of feeding will permit.

Nutritive experts have proved by experiment just how much Starch Equivalent (S.E.) and Protein Equivalent (P.E.) is required to maintain an animal. Obviously a large animal will have greater requirements than a small one. For example an 800 pound cow requires for maintenance 19 pounds dry matter, 5·1 pounds S.E. and 0·51 pounds P.E. A 1,000 pound cow will require 22 pounds dry matter, 6·0 pounds S.E. and 0·6 pounds P.E.

It is also known what the food requirements are to produce a gallon of milk in addition to maintenance. The amount of food required to produce a gallon of milk varies with the amount of butter-fat present. A rich milk requires extra food.

A 900 pound cow producing two gallons of milk daily with a 3·5 per cent butter-fat test needs the following food:—

	Dry Matter.	Starch Equivalent.	Protein Equivalent.	Nutritive ratio.
	lb	lb	lb	
Maintenance 900 lb cow	20·5	5·5	0·55	
Production 3·5 per cent butter-fat 2 gallons milk daily	....	5·0	1·0	
Total	20·5	10·5	1·55	under 1 : 7 ¢ 8

How well does good young Para grass supply these requirements? It has been observed at the Department's Livestock Farm that the average cow consumes in the vicinity of 150lb Para grass daily, comprising the following: dry matter 40·8 pounds, S.E. 18·75 pounds, P.E. 1·5 pounds, with a nutritive ratio of 1 :/4 ¢ 5.

It will be seen that for the cow mentioned above there is a great excess of dry matter and S.E. though barely enough P.E. Further the nutritive ratio is far too wide and consequently all of the 1·5 lb P.E. would not be utilized by the beast for production. In other words, a ration of 150 pounds Para grass is just sufficient to maintain the cow but not adequate to produce two gallons of milk daily. This does not signify that it is impossible for a cow to produce two gallons of milk on this ration, but to maintain a daily average of two gallons she would be doing so at the expense of her own body protein and if properly fed would produce far more than that obtained. The cow with the maximum potential average of two gallons could not produce this amount and maintain it for any length of time. On such a ration the farmer would not get all the milk his cow was capable of producing. This is one of the main causes of low milk production in Fiji. Local cows may have a high potential

production mark which they cannot attain on account of the poor quality fodder offered. If the amount of Para grass is increased to supply more P.E. there is still the wide nutritive ratio to cope with; and before the P.E. requirements are satisfied the bulk of dry matter becomes more than the animal can satisfactorily manage. Para grass alone is therefore useless for milking cows.

Some farmers attempt to make up this deficiency by supplying coconut meal which is reasonably rich in P.E and has a narrow nutritive ratio.

The table above shows that 150 pounds Para grass has an excess of dry matter and S.E. If coconut meal is to be included in the ration it is therefore necessary to reduce the quantity of Para grass. If one pound coconut meal is fed and the Para is reduced to 100 pounds the following is found:—

	Dry Matter.	Starch Equivalent.	Protein Equivalent.	Nutritive ratio.
	lb	lb	lb	
100 lb Para grass	27·2	12·5	1·0	
1 lb coconut meal	0·97	0·76	0·156	
	28·17	13·26	1·156	1: 12 • 6

The nutritive ratio is far too wide and there is too great a quantity of dry matter and S.E. while the P.E. is very deficient. To amend this a further reduction of Para grass and an increase in the coconut meal would be necessary.

A ration of 75 pounds of Para grass and six pounds of coconut meal supplies the P.E. requirements; but the nutritive ratio is still too wide at 1 : 8 : 7. There is also still an excess of dry matter and S.E.

	Dry Matter.	Starch Equivalent.	Protein Equivalent.	Nutritive ratio.
	lb	lb	lb	
50 lb Para grass	13·6	6·25	0·5	
7 lb coconut meal	6·79	5·32	1·092	
	20·39	11·57	1·592	1 : 7 • 4

This ration contains sufficient S.E. and P.E. and the nutritive ratio is within the required range " of under 1 : 7 • 8. There is a slight deficiency of total dry matter which, since it is slight, can be ignored. A similar deficiency of P.E. would, however, be cause for concern. Thus 50 pounds of Para grass and seven pounds of coconut meal daily satisfies the requirements of a 900 pound cow producing daily two gallons milk with a 3·5 per cent butter-fat test. If this cow produced three gallons milk daily then an extra three pounds coconut meal would have to be fed. Consequently it is observed that the ration must necessarily vary with the cow and her production. It is expecting a lot of the busy farmer to advise him to adopt the methods used above for each of his cows. This is successfully overcome in other countries by working out a basal ration for the herd and a given quantity of a concentrate mixture is fed per gallon of milk. The farmer is not taxed with a long mathematical problem each time a fresh cow enters the bail. This system and its adaptations to local fodders and conditions will be dealt with in another of this series of articles.

There are three major objections to the ration mentioned above.

1. The practical farmer will immediately raise the question as to whether a 900 pound cow on adequate Para grass will eat seven pounds coconut meal. Preliminary observations made at the Sigatoka Livestock Farm reveal that the average cow will not eat this quantity of coconut meal even when mixed with a little molasses. More frequently the daily consumption is only half this quantity. Seven pounds of coconut meal, if eaten, would cause digestive trouble and produce a " hard " butter.

2. Practical farmers will also raise the question of cost. Coconut meal at £11 10s. per ton (the present landed cost at the Livestock Farm) works out at 1·2 pence per pound. Thus in the above ration coconut meal alone would work out at 8·4 pence for two gallons or 4·2 pence per gallon. In the case of butter fat, the cost for coconut meal would be 1s. per pound butter fat. Naturally, the higher the production the lower the proportionate cost per gallon for fodder. As stated above a 900 pound cow producing three gallons of 3·5 per cent test milk requires an extra three pounds coconut meal. Thus the cost of coconut meal for the third gallon would be 3·6 pence as against 4·2 pence for each of the first two gallons.

3. It is felt, however, that under Fiji conditions, 8·4 pence for two gallons milk or 1s. per lb butter fat is rather a high portion of the production cost for meal alone, even if a beast would eat the quantity.

4. The last objection to the use of coconut meal as the sole concentrate is a technical one. Animals require a wide range of proteins. Some protein-rich foods have a narrow range of protein types on which an animal could not thrive. Consequently there is always a risk when using a sole concentrate of omitting essential protein types. It is known that coconut meal has a wider range of protein types than the grain concentrates but not as wide as soya bean and peanut. Since it is incomplete in the range of protein types it is a bad practice to use a limited source of proteins such as in the above ration.

It is obvious from the above that without taking into consideration the mineral and vitamin requirements the Para-coconut meal ration is far from ideal for milking cows. In order to provide production and maintenance requirements such a large quantity of meal has to be supplied that the average cow on Para is unwilling to eat it. If she will she is liable to be made ill and the cost would be prohibitive. This should not be interpreted to mean that coconut meal is not a good dairy cow concentrate. It is an excellent one. The fault lies with the Para grass. Just what the farmer is recommended to use in place of this mixture is to be dealt with in other articles of this series.

2. HINTS TO THE BACKYARD POULTRY KEEPER

How to make a Brooder.

Heavy losses of imported day old chicks have invariably been due to faulty brooder conditions. Great improvements have been obtained by giving attention to proper management. Brooders may be too large at first—but too small when the chicks are six weeks old. Once a young chick gets cold it becomes liable to many troubles and frequently dies. For the successful artificial rearing of day old chicks, the following conditions are essential; cleanliness, adequate floor space, warmth, dryness, fresh air, direct sunlight and freedom from draughts. To obtain these conditions the chicks must have a well made brooder which may be constructed as follows:—

Take four lengths of 10" x 1" (ten inches by one inch) timber three feet long, nail together to form a square. Floor one side with similar timber. At one end cut a small doorway six inches high by four inches wide and fit a sliding door. Seven inches up from the floor, place a ledge of inch timber to carry the lid. The lid must not fit tightly and should be detachable Line the under surface with two or three thicknesses of sacking, to the outer layer of

which is sewn, to hang downwards in rows approximately an inch apart, strips of flannel five and a half inches long and one and a half inches wide. Drill five half inch ventilation holes in each side. Cover the floor with chaff, but if this is not readily procurable a thick layer of rice bran or sawdust can be substituted.

This type of brooder is known as a cold brooder and the only heat used is that of the chicks' bodies. A brooder of this size will accommodate 25 chicks.

Until the chicks are two or three days old, they should be held in the brooder and let out for a short period every two or three hours, that is when feeding and during the warmth of the sun at mid-day. The temperature inside the brooder is very important and careful attention should be given to avoid either under stocking or over crowding. If the brooder is too large for the number of chicks, their bodies cannot supply enough heat and if over-crowded too much heat is generated. Both conditions expose the chicks to chills. Here is a simple guide to these conditions. Cold chicks huddle together and cheep. Hot chicks spread out and the floor litter is damp.

When the chicks are first brought to the brooder they should be supplied with water and fine shell grit. When 24 hours old their first feed is given. The general practice is to give No. 1 chick feed until three weeks old and No. 2 feed until six weeks old. These feeds are finely broken grains and are not easily procurable in Fiji. Under local conditions chicks can be successfully reared right from the start on imported poultry mashes and a liberal supply of fresh green feed. It is advisable to feed dry mash in preference to wet when chicks are artificially reared. If possible add finely ground maize to the evening feed. At eight weeks chickens are ready to be taken from the brooder and be put on full adult ration.

—T. L. MUNE.

ECONOMIC BOTANY NOTES

By B. E. V. PARHAM

1. RECENT PLANT INTRODUCTIONS

Brief notes on recent introductions are given below. Some of these are of considerable value and limited quantities of seed or cuttings are available for distribution to farmers throughout the Colony.

In 1944 Professor D. Paterson and Dr. K. S. Dodds brought with them from Trinidad seeds or cuttings of 37 species and varieties comprising six grasses, three cereals, two legumes (fodder), eight pulses and beans, three oil seeds, five fruit and nut trees and 10 ornamental trees. With a few exceptions the introductions have been successful and the permanent trees have been planted out in suitable situations or distributed, and the annual crops have been propagated for seed production.

Other introductions have been received from the Plant Research Bureau, Dept. of Scientific and Industrial Research, New Zealand; the Division of Plant Industry, C.S.I.R., Canberra; the Department of Agriculture, Brisbane, Queensland; and the Agricultural Experimental Station, Honolulu, Hawaii. These are referred to below; the numbers refer to the plant introductions register of the Department.

GRASSES AND FODDER PLANTS.

1. *Tripsacum laxum* Nash.—Guatemala grass (P.R. 205) from South America. This is a robust grass of rapid growth locally and with the habit of a stemless sugar cane, growing about six feet high. Production of green material has been by means of sample plots and equals 63,500lb per acre per annum. The whole plant is readily eaten by stock and appears to be a useful addition to the fodder plants for the small holder.

2. *Pennisetum purpureum* Schum. I.C.T.A. strain: Elephant grass (P.R. 239).—An improved strain from Trinidad, this has grown well and gives a large quantity of succulent palatable fodder. It is not so woody as the other strains to be found locally.

3. *Melinis minutæflora* Beauv. Molasses or Wynne grass (P.R. 207) from Jamaica.—This is the second introduction of this species which was previously established in 1934. It is easily established from seed, grows rapidly and produces very heavy yields of green fodder. This is readily eaten by stock when chopped but is not preferred to Para in the field. The species appears to be valuable for rapid grassing of bush burns and will grow on hillslopes where conditions are not favourable to the growth of Para grass.

4. *Pennisetum pedicellatum* Cream seeded var. Kyasuwa grass (P.R. 275).—A native of Africa introduced via Trinidad. This grass is easily established from seed, grows rapidly, is palatable to stock before flowering but soon develops abundant flower heads and large quantities of seed. It is very much superior to the so-called Mission grass which is now widespread in the Colony, and further work is planned before it is recommended for distribution. Its free seeding habit and rapid growth would suggest its usefulness for the hillslopes of the dry zone. A brown seeded variety has also been established.

5. *Sorghum verticelliflorum* var.—Kavirondo sorghum (P.R. 206) is amongst the most valuable of recent introductions which has already been reported upon(1).

6. *Chloris gayana* Sw. Rhodes grass (P.R. 241).—This introduction from Canberra (C.P.I. 6561) has proved most successful. It is the first strain of many introductions of this species to become readily established. Its high seed production, coupled with its stoloniferous growth assisting vegetative propagation, are useful features.

7. *Digitaria melangiana* (Woolly Finger grass) (P.R. 211).—This species is growing extremely well and shows much promise. It rapidly spreads by means of long rooting branches and forms an excellent cover with a minimum of soil preparation.

LEGUMES.

Recent further introductions of tropical Kudzu and *Calopogonium muconoides* (P.R. 1224) have become well established and material is available for distribution. In grazing trials the former has proved the most attractive of all the leguminous fodder plants so far tested. Both are also readily eaten when cut and mixed with Para or other grass. In this connexion the following are also under trial. *Cassia mimosoides* (P.R. 1299); *Serbania aculeata* (P.R. 1299).

Other recent introductions are:—

Trifolium arvense L. Haresfoot Trefoil (P.R. 1364).

Lotus major Sm. A.150. (*L. Uliginosus* Schkuhr). (P.R. 1365).

Tallarook Sub. Clover Ak 165. *T. Subterranean* L. (P.R. 1366).

Mt. Barker Sub. Clover Ak 164. *T. Subterranean* L. (P.R. 1367).

Ord. White Clover Ac 2556. *T. repens* L. (P.R. 1368).

Pedigree White Clover Ac 2549. *T. repens* L. (P.R. 1369).

Montgomery Red Clover Aa 567. *T. protense* L. (P.R. 1370).

Broad Red Clover Aa 595. *T. protense* L. (P.R. 1371).

Trifolium procumbens Hop Trefoil (P.R. 1372).

Lespedeza sericea Korean Lespedeza (P.R. 1348) from Canberra.

PULSES.

Cajanus cajan (L) Millop. Pigeon's pea (var. St. Augustine A) (P.R. 1339.) An improved strain introduced by Professor Paterson has been grown at Sigatoka and Dobuilevu where medium yields of seed have been obtained.

Canavalia ensiformis Dc. White Sword bean (P.R. 1223) has grown well at Sigatoka and Dobuilevu. The variety produces a good yield of beans suitable for table use.

Phaseolus aureus (P.R. 1337), and *P. mungo* (P.R. 1332) (green grain and Urd or Woolly Pyrol respectively) including an improved British Honduras strain, were also introduced in 1944 and have given very satisfactory results.

Glycine max. Soya bean (P.R. 1338). Three varieties—Venezuela yellow, Otootah black and Cherokee green have been grown from seed received from Trinidad but none has been very satisfactory to date and further trials are being made.

CEREALS.

Zea mays. Improved strains of White Sweet corn and Yellow dent corn were received from Trinidad, and have grown well. There has been no demand for the seed and propagation has therefore been limited to station seed production only.

Coix lachryma-jobi L. var., Adlay (P.R. 253). An improved selection of this cereal received from Trinidad has given excellent results in growth and yield but the crop is unknown locally and there has been no demand for the considerable quantity of seed raised.

Sorghum vulgare (Grain Sorghums). The following varieties have been grown at Sigatoka with success and seed has been made available for distribution: Milo, Kilo, Hegari White, Hegari Red. In view of the shortage of grain locally for stock and poultry feed, the cultivation of this valuable crop could well be developed. It grows very satisfactorily in Fiji and is well suited for small holder farms.

VEGETABLES.

Tomato var. Pearl Harbour (P.R. 4616). A small quantity of seed received from the Agricultural Experimental Station, Hawaii. This variety is resistant in Hawaii to the virus disease known as spotted wilt.

OIL SEEDS.

Guizotia abyssinica Cass. Niger seed (P.R. 5758). This annual oil seed crop appears to be unknown locally. It also may be used for green manure and silage. Growth and yield appear satisfactory but there has been no demand for seed from local farmers.

Helianthus annuus L., Sunflower (P.R. 5755). A very large flowering strain introduced from Trinidad has been grown very successfully at Dobuilevu where production has been well beyond any local demand.

FRUIT TREES.

Lecythis zabucajo Aulb. Paradise nut (P.R. 2796). Germination of seeds from Trinidad was good and resulting seedlings have been established at stations.

Mammaea americana (P.R. 2356).—Germination was very poor—one tree has been established.

Dipteryx odorata Willd. Tonka bean (P.R. 1251).—Germination was fair and seedlings have been established.

TREES—ORNAMENTAL.

Cassia javanica L. (P.R. 1215). Seedlings were raised and distributed.

Tabebuia pentaphylla (P.R. 4882) from Trinidad. Large numbers of seedlings were raised and distributed. This is the first introduction of this ornamental tree, which is noted for its profuse yellow blossoms.

REFERENCE.

(1) Parham, B. E. V., 1946.— "New Fodder Crops for Fiji: Perennial Kavirondo Sorghum". *Agricultural Journal*, Fiji, Vol. 17, No. 4, p. 113.

2. CITRUS ROOT STOCKS

Local readers will be familiar with the limitations to the use of Seville or sour orange as a root stock for sweet oranges and mandarins, as there are many examples of the unthrifty growth which develops in the case of such trees. Experience has shown that this variety is most successful as a stock for grapefruit, lemons and limes, a high percentage of takes being obtained and the resultant trees being healthy and normally productive.

In a very interesting report(1) on the problem, Dr. P. C. J. Oberholzer of the Department of Horticulture, Agricultural Research Institute, University of Pretoria, has recorded the results of work which suggest that this incompatibility may be due to a pathological condition due to a virus. His conclusions are as follows:—

" While it is realized that further evidence is needed before final conclusions can be drawn, the results obtained nevertheless prompt one to suggest the following tentative hypothesis:—

1. The incompatibility reactions exhibited by certain stock-scion combinations of citrus in South Africa are probably caused by a virus, which is present in a latent form in certain species or varieties (e.g. Valencia orange), and only causes pathological conditions when certain stock-scion combinations are made.

2. Preliminary results indicate that such a virus is satisfactorily (if only temporarily) eliminated by taking the infected, but apparently healthy, scion variety through the seed, making use of the well-established principle of "nucellar embryony" characteristic of the genus *Citrus*. By using buds from such nucellar seedlings, healthy and exceptionally vigorous budlings have been produced of hitherto incompatible combinations, e.g. Valencia orange on sour-orange and lemon rootstocks. Provided infection does not take place mechanically, or by means of an insect vector, such plants will probably continue to make healthy growth.

3. The insertion of buds of the particular scion-variety (e.g. Valencia orange), taken from a normal budded orchard tree, into such healthy budlings causes infection within a relatively short time, resulting in the typical symptoms of decline, root decay, etc. This tends to indicate that the virus is readily transmitted by budding.

4. Finally it would appear, from experience and general information available, that the incompatibility reactions found in South Africa, Java and parts of India, especially as far as the sour-orange is concerned, probably bear a direct relation to the problems of "Tristeza" and "Quick Decline", and that the underlying cause in each case is probably a virus. Furthermore, experience in South Africa and elsewhere strongly suggests that this virus is infectious, being distributed by other means as well as by budding."

REFERENCES.

(1) Oberholzer P. C. J. 1947. "The Bitter-Seville Rootstock Problem" Farming in South Africa. Vol. 22, No. 255, page 489.

3. DISEASE OF TARO

In July last the Senior Agricultural Officer, B.S.I.P., recorded the occurrence of a suspected virus disease which had destroyed the entire taro crop on the Shortlands and which was thought to be also on Choiseul. He considered this disease spread from Bougainville and represented a very serious threat to the taro crop in the Protectorate.

The symptoms as reported had suggested the cause to be a virus, the plants suddenly wilting and rotting away. No trace of insect damage has been found nor were signs of fungoid growth noted. It was at once recommended that the export of all roots, soil and planting material from the Shortlands should be prohibited, in an endeavour to prevent the spread of the disease further east.

The taro beetle has also caused severe damage to a crop in hill gardens.

The disease has since been determined as caused by the fungus *Phytophthora colocasiæ* Rac. which has been recorded in a number of countries, India, Java, Philippines and throughout south-eastern Asia. The disease starts in the form of small, dark specks which widen rapidly to form distinct spots which may coalesce to involve a large part of the leaf surface. The petiole and corm are also attacked and in severe cases the whole plant is killed.

4. MARRAM GRASS

Recently through the courtesy of Mr. Jenkins, Engineer to the New Zealand Public Works Department at Nadi, 600 plants of Marram grass were received from Woodville, Auckland. These have been planted on the coastal dunes at Sigatoka, where it is hoped they may become established and help to check the movement of the sand. This grass which is a native of Europe and North America is well known and has been widely used elsewhere for this purpose.

CHEMISTRY NOTES

BY L. E. SMYTHE, M.Sc., A.R.I.C., A.A.C.I.

"SOIL SCIENCE IN FIJI"—PART I

Both agriculture and silviculture are concerned with the soil as a medium of production. As far back as three thousand years ago, the cultivation of the soil by the Bronze Age farmer, was already an ancient craft. From the earliest times, it has been becoming more and more apparent that the soil is perhaps our most important basic resource.

We may perhaps understand something of the importance of the soil, if we reflect on the words of Henry A. Wallace(1): "The Earth is the mother of us all—plants, animals, and men. The phosphorus and calcium of the earth build our skeletons and nervous systems. Everything else our bodies need except air and sun comes from the earth".

"Nature treats the earth kindly. Man treats her harshly. He overploughs the cropland, overgrazes the pastureland and overcuts the timberland. He destroys millions of acres completely. He pours fertility year after year into the cities, which in turn pour what they do not use down the sewers into the rivers and the ocean."

In Fiji the above words are no less important. We have been taking "all" from our soils for upwards of 50 years, and, with very few exceptions, are not replenishing the lost nutrients. Admittedly some tropical soils are among the most fertile in the world but it would be foolish to expect these to go on producing indefinitely.

The decline in fertility of a soil is sometimes very apparent and often a virgin soil will become economically unproductive, after the first crop. More often than not, however, the decline is a gradual one and may be almost imperceptible, except to those who are particularly interested in the soil.

It is time to worry therefore, when, for instance, over a number of years the percentage overall yield of butterfat per dairy cow shows a marked decline. Also it is time to worry, when the size and quality of bananas, other factors being eliminated, show a decided deterioration compared with that of some 30 to 40 years previously. Improved stock, improved stock hygiene, and improved banana disease control may be overshadowed by the depletion of essential plant and animal nutrients.

Although this state of affairs may not be the exclusive outcome of depleted soil fertility, no one will deny that the nutrient status of the soil must necessarily play a very important part.

As far as Fiji is concerned, even if we are not now seriously affected in the above manner, it would perhaps be opportune to survey the soil scene.

In the "dry" zones of the two major islands we have a perfect picture of the way in which the forces of erosion have commenced to reduce the land surface to a series of "gullied" and "sheet" eroded hillsides. The destructive policy of burning off, has contributed in no small manner to such eroded land as we have. Burning off, especially preceding the "wet" season, is a great help to our enemy erosion. Unnecessary clearing, and the felling of trees, also helps this enemy.

In one area of some 8,000 acres recently visited, no less than four grass fires were burning at the same time. This was no isolated case, as similar fires are burning almost continuously in the dry-zone areas. It is difficult to ascertain why such fires are started and more difficult to apprehend the person or persons starting them. It is certain, however, that most of them are man-made.

Erosion, if unchecked, is the surest way of destroying the physical structure and fertility of a soil. Fortunately, erosion is not particularly widespread in the " wet " zones, due to the rapid growth of plant cover. It is necessary to check erosion in its early stages if we are not to be faced with the financial burden which is now the lot of many countries.

A system of " shifting cultivation " is the answer to any temporary soil fertility problems. While this may be practicable for the native gardener-farmer, it is not so for present day agriculture. The solution must necessarily lie in a thorough appreciation of the nutrient status and physical properties of the important soil types in Fiji; upon which we may base a system of sound soil management. Armed with this information, which is not quickly forthcoming, the soil scientist may advise as to the appropriate management (e.g. fertilizer requirements or modification of physical properties), of the particular soil type.

The first systematic step to obtain the necessary information would be the undertaking of a reconnaissance soil survey of Fiji. In such a survey the extent and boundaries of the various defined soil types are delineated on a map of the area concerned. In addition, information regarding the nutritient status and physical properties of the particular soil types may be found in the report accompanying such a map. The survey is designated " reconnaissance " owing to the fact that the soil boundaries are only approximately delineated. It is left to a later and more detailed survey to fill in the framework of our knowledge of Fiji soils.

Detailed soil survey occupies much time and is undertaken with a view to the solution of some particular problem or problems and, also, may be the basis of a system of land-classification for land-use planning. In a detailed soil survey the soil type boundaries are accurately delineated and it is possible for the landowner to manage individual areas of his holding, according to the needs of the particular soil type and, also, to cultivate the most suitable crops for the particular soil type. As the soil is a product of " soil climate " which is in turn dependent upon " climate " as we know it, the soil scientist considers very carefully such factors as rainfall, drainage, evaporation, geology, geographical landscape, native vegetation associations and elevation.

A " soil type " may be defined as a group of soils having genetic horizons similar in differentiating characteristics and arrangement in the profile. The texture of the surface soil of the one soil type, is the same and the soil is developed from similar parent material. Soil types are named, the name being a combination of the place or series name and the textural class name. For example, Fiji soil types might include: Colo clay loam, Navua silty loam and so on.

A reconnaissance soil survey of Fiji is, in fact, envisaged in the near future. With present staff, it should be possible to map and classify all the major soil types in the Colony in approximately three years. In addition, information regarding the nutrient status and physical properties of the defined soil types will be available.

During the course of this survey, a limited amount of time will be available for the investigation of special problems in connexion with soil fertility, fertilizer practice, detailed survey, erosion studies and so on. This work will embrace both agriculture and silviculture and include other territories of the Western Pacific High Commission.

The long term plan would be to ultimately provide a system of land classification for land-use planning, and an efficient soils testing and soils extension service, for the farmer. This is a recognized feature of agriculture in the more highly developed areas. It is important to realize, however, that the future and success of soil science in Fiji, as an integral part of our agriculture, will depend upon the facilities and finance made available for such work. It is to be hoped that soil science, aiding the conservation of our important basic resource, the soil, will play an important part in any drive for increased agricultural production and the building up of a more than favourable trade balance.

REFERENCE.

(1) 1938. Wallace, Henry A., Secretary of Agriculture, in foreword to " Soils and Men ", U.S. Department of Agriculture, year book.

ENTOMOLOGICAL NOTES

1. ARMY WORMS

As a rule army worms are not detected until they are two to three weeks old and have already done considerable damage. This is unfortunate, since by then they have already spread widely and become strong, and control measures cannot be effectively applied. This state of affairs is, however, unnecessary since it is possible to detect the pest at a very early stage.

The two chief factors conditioning an early outbreak are hot weather, especially hot nights, and an abundance of young luxuriant grass or grain.

The hot nights are a prerequisite, otherwise the moths cannot deposit many eggs. The presence of young grass is essential since the caterpillars, while very young, cannot exist on older grass. These conditions obtain in the pastures under certain tropical conditions.

As soon as the infestation is discovered, control measures should be applied, but previous organization is necessary. One of the best methods employed to-day is the utilization of a dusting pump for dusting infested spots with an insecticide. A handy powder blower costs about £6 and has a capacity for holding about 20 to 40 lb of powder. An acre can easily be treated in a matter of an hour or two. Various suitable powders are available. A five per cent DDT insecticide has been found most suitable for destroying the worms in the first four instars. Worms of the fifth and sixth instars are almost fully developed and at this stage Cryolite powder is a more effective insecticide. Depending on the age of the caterpillars, about 10 to 20 lb of insecticide per acre is required for good results. Criolite* costs about fourpence per lb and DDT about sixpence. This treatment is definitely worth while. Not only does it save the crops but it also prevents the insects from spreading—the factor which counts for the most extensive losses.

*In Fiji a spray solution made of 3½ oz. Kryocide in three gallons water with three ounces mollasses as a spreader has proved very effective for control of army worm in rice fields and other crops.

[Extract from " Farming in South Africa " Vol. 22, No. 250 dated January, 1947, page 41.]

2. PLAESIUS BEETLE

Recently the Department of Agriculture received a request from the Honolulu authorities for a consignment of beetles for the U.S. Navy.

These beetles (*Plæsius javanus*) which are found in banana plantations where they live upon the larvæ of the destructive weevil-borer (*Cosmopolites sordidus*) were originally brought to Fiji in 1913 from Java by the then Government Entomologist (Mr. J. F. Jepson). The U.S. Navy is responsible for the rehabilitation of the Pacific Islands formerly held by Japan and the beetles were required to assist with the work by devouring the borers in newly established banana plantations.

It was at first intended that an Entomologist should come from Hawaii to collect and transport the beetles; but the offer of the Department of Agriculture to do this was accepted and on 10th July, a Fijian Laboratory Assistant proceeded to the district of Waimaro to begin work. Altogether, in five days, 460 beetles were collected. These were brought to Suva on 16th and were fed on fresh beef-steak and packed in damp moss for the long journey, first by road to Nadi and thence by air to Honolulu and beyond. Leaving Nadi by Pan American Clipper on 18th July the box of living insects arrived at Honolulu the following day, where Dr. Pemberton, Entomologist of the Experiment Station of the Hawaiian Sugar Planters' Association, took delivery and immediately transferred it to a Navy plane which left for Guam half an hour later. The consignment was scheduled to reach Guam 22 hours later and a despatch was sent to insure the insects being received and released without delay in a locality already selected.

In five days these beetles were transported from the banana plantations of the Waidina River on Viti Levu to the island of Guam 6,093 miles away.

Acknowledging the receipt of the beetles, Dr. Pemberton has written to the Director of Agriculture as follows:—

"We are all highly pleased with the condition of the shipment, your effective method of packing the material and the promptness with which you have co-operated with us. I do not know of a similar instance in which a beneficial insect has been transported from one country to another, over such a long distance, so quickly and satisfactorily. We wish to thank you most heartily and congratulate you on the service you have rendered us in this project."

Such projects serve to illustrate the routine work of the Department of Agriculture and are not usually given publicity; nor is this the first time that these beetles have been sent to far distant places* to carry on their useful work. The present case is noted because it was handled in a minimum of time by locally trained Assistants and because it is a good example of the long continuing value of such work as that carried out by Jepson 34 years ago.

*Jamaica, Cook Islands, Tahiti 1942. Hawaii, Puerto Rico 1942. —B.E.V.P.

LEGISLATION

PRICE OF RICE.

The maximum retail price of rice throughout the Colony was fixed at five pence per pound by Price Control (No. 21) Order made at Suva on the 2nd September, 1947. The previous price orders were revoked in so far as they affect rice and padi which had been subject to maximum prices of 3½d. per pound and £14 per ton respectively.

PROTECTED INDUSTRIES. (INDUSTRIAL OIL) ORDINANCES 1947.

In accordance with section 8 of the Ordinance, notices of application for the grant of a licence to carry on the industry have been advertised by three firms:—

Messrs. Industrial Oils (Fiji) Ltd.
Messrs. Burns, Philp (South Seas) Co. Ltd.
Messrs. Island Enterprises (Fiji) Ltd.

COPRA BOARD.

The Copra Board was reconstituted on 21st July, 1947, when the following were appointed to be members for a period of one year with effect from 17th July, 1947—

The Director of Agriculture (Chairman).
The Secretary for Fijian Affairs (or his representative).
Mr. W. J. Brabant, Acting Senior Assistant Accountant, Accountant-General's Department.
The Hon. H. B. Gibson. Mr. J. V. Tarte.
Mr. C. W. Aidney. Mr. S. H. Wilson.

The Committee of Management to carry out day to day business of the Board comprises the Director of Agriculture, Mr. W. J. Brabant, Mr. C. W. Aidney. The first meeting of the Board was held on 8th and 9th September.

NATIVE FISHERIES COMMISSION.

By Legal Notice No. 105* the Rules made by the Native Fisheries Commission have been proclaimed. The forms to be used in recording the boundaries and owners of fishing rights are provided in the schedules published with the Notice.

* 1947 *Fiji Royal Gazette Supplement*, No. 25, Friday, 11th July.

MARKET REGULATIONS.

By Legal Notice No. 95† the Market Regulations 1947 made under section 4 of the Markets Ordinance, Cap. 70, were published.

Necessary definitions are given and the conditions of management, control and use of markets are explained. A market is defined as a place established outside the limits of a town or township in pursuance of section 2 of the Markets Ordinance. Limitations on the sale of produce at any place within two miles and of fish at any place within one mile of a market are described, and the usual provisions made for the proper conduct and maintenance of market precints.

† *Fiji Royal Gazette Supplement*, No. 24, 4th July.

NOXIOUS WEEDS (AMENDMENT) REGULATIONS.

On 18th September the Noxious Weeds (Amendment) Regulations 1947 were made by the Governor in Council. Part 5 of the principal Regulations were thereby revoked and 13 plants were declared to be noxious weeds in the Colony. Details are given elsewhere in this issue.

EXTRACTS

COMPOST VERSUS ARTIFICIALS IN BRITAIN

By JOHN MANOR

Only the increased use of machinery can compare with the vastly increased use of artificial fertilisers as a major development in British farming during the war years of World War II. Not only did the Ministry of Agriculture sponsor out-of-season price adjustments to level out peaks in delivery of nitrogenous fertiliser; but at one time compulsory orders were served by War Agricultural Executives regarding spring top dressings of nitrogen for cereal crops.

This activity in fertilisers, rather than any failures from artificials, served to stimulate those who held the view that artificial, i.e. inorganic-fertiliser can at best, never be more than palliative and, at worst, a drug which rapidly exhausts any inherent soil fertility. It has to be pointed out, however, that, whereas the anti-artificial or compost school condemn almost all mineral and synthetic fertiliser out of hand, those who have a use for artificials admit also the fundamental need for humus and organic fertilisers.

NEED FOR HUMUS.

Although it has been claimed that a second " Black Death " will follow the continued use of artificials, there is, as yet, no scientific evidence to support the claims that the health-giving properties of food grown on " naturally " fertilised land are greater than those from food grown on land fertilised intelligently with artificials. The need for humus is never doubted; and it is probable that the humus content of run-down land can be restored more quickly by the ploughing of green crops and crop residues grown with the aid of artificials than by any other method.

The common-sense view is that humus increases the soil's moisture holding properties. A soil rich in humus, therefore, will hold its moisture during drought and the crop is able to continue taking up slowly a solution of plant nutrients irrespective of moisture falls. Note the phrase " slowly take up " in contrast to rapid absorption which cannot always be avoided with heavy dressings of artificials which would give quick growth with consequent softness that readily wilts or rots according to climate or other conditions which may follow.

The growing of three- or four-year leys—either with or without fertilisers, as the occasion demands—to be ploughed under not when they have ceased to be productive, but at the peak of their productivity, is the form in which these views are translated into practice on the majority of farms. And many thousands of acres in Britain are now farmed under the ley system which was so ardently preached by Sir R. Stapledon up to the time of his retirement in 1946.

The comparative few who rigidly eschew artificial fertilisers convert all vegetable matter into compost and even naturally made farm-yard manure from cowshed, yard, or loose box is said to be improved by " lacing " with any surplus vegetable matter, straw, or weeds and frequent turning. The latter give aeration and assist the development of beneficial bacteria which not only convert the compost into readily available plant food but also continue their good work in the soil of which they will eventually become part. Deep subsoiling is also strongly advocated to give aeration.

Mechanisation has rendered compost making more nearly generally practicable than ever before. There are manure shifters easily capable of turning over 20 tons per hour. Two methods are available: pits are the ideal, heaps will serve where excavation is impracticable.

In either filling a pit or making a heap, space must be left in which to begin turning the material. According to Sir Albert Howard, the great authority on compost, a pit or heap 30 ft. long by 14 ft. wide by 3 ft. deep is of correct proportions for about 1,000 tons per annum.

VERTICAL VENTILATING SHAFTS.

Filling or heaping takes place in five feet sections and to a total height or depth of five feet. First, six inches of waste vegetable matter, then a sprinkling of earth (about $\frac{1}{8}$ inch thick) followed by watering with a hose. This is repeated to the required depth. Three vertical ventilating shafts are made with a crowbar, thus spacing them about three feet six inches apart.

In wet weather no water is needed and at all times watering will depend on how moist is the vegetable matter being used. The mass must never be really wet, nor even allowed to dry out completely.

The heap should be ready for turning after about three weeks, and in the process outsides will go into the middle. Sufficient watering may be done to make the mass moist but not wet. Vents are re-made after turning. After a further two weeks the heap should be turned again the reverse way and after a total period of three months the compost will be ready for use at its best.

Perhaps the leading example of an English farmer who uses no artificials is Mr. Friend Sykes, Chantry, Chute, Wilts. He waters all the muck in his stock yard (earth floors, never concrete) and then heaps it with a Rapier muck shifter adding up to four times the weight of the muck in the form of ditch clearings, hedge cuttings, weeds or any waste of vegetable origin.

He turns it twice at two-to-three-weekly intervals with the machine and aims to use after 90 days when it is at its best. He claims to have loaded, carted and spread 400 tons in two days at a cost of 1s. 8d. per ton. For spreading he uses a revolving flanged plate mounted on, and operated by, a converted back axle of a motor-car.

After costing all the machinery and labour involved Mr. Sykes shows that his compost costs 4s. 6d. per ton when spread on the land. He can give numerous examples of improved health in his livestock without the use of artificials; but in addition to quality he shows that compost will give quantity. His land is up 800 feet above sea level and the soil is thin, mainly overlying chalk. Yet he has grown up to 35 cwt. of oats per acre followed by 26 cwt. per acre of wheat, with a third heavier crop of wheat the following year after several summer ploughings. Another feat is the growing of 50 tons of mangolds per acre after dressing with compost a field on which ryegrass and rape would not germinate although it had received $\frac{1}{2}$ ton per acre of basic slag.

FURTHER POINTER.

This, then, is a broad indication of composting in England. If farm incomes become no lower than they are now it is likely that the making of compost will increase with muck shifters reducing labour costs. But only an enthusiast can see it becoming popular during this century. Beef production has for so long been relatively unprofitable in Britain with consequent lack of farm-yard manure in arable districts that the need for organic fertiliser or compost could become acute and cause a sudden general resort to compost. A further pointer in this direction is that the sheep population, particularly in folded arable flocks, has declined by some six millions. For the time being, however, green crops and short leys are mainly used for maintaining humus.

Among growers of market crops the use of compost is spreading and will spread. The demand for organic fertiliser, ranging from bones to shoddy, has for long outstripped the supply. Growers begin composting as the cheapest and quickest way of disposing of crop residues and they find that compost is well worth while for its own sake.

It has been amply proved in practice that the improved humus content of the soil improves the moisture holding capacity in dry areas while the same improved physical assists drainage in wet climates. In other words the soil becomes like a sponge holding a proper amount of moisture ready for absorption by the plant.

RECONSTRUCTION OF AGRICULTURE IN SOUTH AFRICA

Although, from a production point of view, the year was most abnormal, considerable progress has been made in regard to the reconstruction of agriculture and during the past year the foundation has been laid for a sounder, more stable and more prosperous industry. At the beginning of the year the Government announced its policy in respect of agriculture in a "White Paper". This document should be in the hands of every farmer, and the leaders of the farming community, in particular, should study its contents carefully. The main theme of the White Paper is a plea for conservation farming and economic stability, the only means of achieving a sound and efficient agriculture, capable of contributing towards a higher standard of living and an improved nutrition for the nation as a whole.

The White Paper briefly outlines the proposed programme of action envisaged for developing agriculture to a high level of efficiency and utility and maintaining it at that level. It aims mainly at—

(*a*) encouraging the general practice of conservation farming at an early date, in order to protect and build up our soil, water and useful vegetation; and

(*b*) enhancing the productivity of our farming by raising the education standard of the farmer, encouraging more modern farming methods, raising the efficiency, and so also improving the standard of living of farmers and their labourers, promoting price stability, ensuring a market for the increased production required for better national nutrition, and making better transport and auxiliary services available.

Conservation farming is not merely a synonym for soil-erosion control. We must discard the idea that conservation farming consists merely of the application of soil-erosion control measures, for it has a far wider scope and the malpractices, which have to be eliminated, are extremely deeply rooted. The present piracy farming systems have to be superseded by a new approach aiming at the reclamation of our vegetal cover, and the restoration of our soil and water resources. The key to conservation farming lies in the employment of our farming systems in such a way that they link up with natural conditions in order that the basic causes of erosion, denudation, exhaustion and loss of water can be eliminated. The soil-improvement aspect cannot be sufficiently strongly emphasized for only along this road can farming in our country, with its poor, easily eroded soils and variable climate, be stabilized.

[Extract from "Farming in South Africa" Vol. 22, No. 251, February 1947, p. 79.]

DOMESTICATED EARTHWORMS

This lowly form of animal life is one of man's best friends. Down the ages of history, where man has found fertile land, a great deal of it is due to the earthworm. The black loamy Manitoba soil is very largely the work of this fellow, likewise the fertility of Iowa, Kentucky and the Nile Valley. Since the time of Darwin the worm's place in man's growth of foodstuffs has been extensively studied to find his value to agriculture. Leading agriculturists throughout the world have conclusively proved the valuable effect of a large earthworm population on the fertility of the land. Professor Helbury of New York College of Forestry states . . . "if your soil is suitable there may be 1,000,000 to 2,500,000 worms per acre, weighing 1,400 lb." Investigations carried out by the British Government in the Valley of the Nile (White) indicate that the great fertility of this valley is due in a large measure to the work of earthworms. Observations recorded that the casts of earthworms on these soils during six months' active growing season amounts to 119·79 tons per acre. Imagine this being spread over your farm or garden and the result you would get in the growth and crop.

[The Canadian Social Creditor, Jasper Avenue, Edmonton, Alberta, Canada. Communicated by J. Hildreth.]

VANILLA-GROWING ON DOMINICA

The island of Dominica in the British West Indies has recently become one of the largest producers of vanilla in the Western Hemisphere. Located on the westernmost boundary of the Caribbean Sea, at the same latitude (15° north) as Guatemala on the eastern boundary, an ideal location seems to have been found for this terrestrial orchid, *Vanilla planifolia*.

Introduced many years ago by Jesuit priests, this orchid has been planted throughout the rain-forest of this mountainous little island. It normally climbs up thirty or forty feet and when it has outclimbed its supporting tree, it sends down free hanging sprays. In the dry season, which starts in February, these hanging sprays throw out clusters of small yellow orchids, the fruits from which are harvested nearly a year later.

The crop is cultivated almost entirely by negro peasants in their small gardens, some having only a single vine. An old plant growing under ideal conditions can bear more than thirty pounds of green beans, but this is exceptional. More often a vine will produce about a pound of green beans, which when cured make about three ounces of vanilla, worth about a dollar to the peasant. It does not take many vines to provide a good part of the income of these peasants, who have very modest requirements. The price of vanilla now is so high that the fifty thousands pounds of cured beans comprised the most valuable of the island's exports in 1945. In fact, in the Carib Reserve, vanilla forms the main source of income to-day. It is quite a sight to see the mongoloid Caribs carrying hundred-pound bags of these valuable green beans on their heads for ten or fifteen miles to the dealers or to the co-operative association which cures and markets their beans.

The vanilla plant is sometimes grown under coffee trees, which, some two hundred years ago, were the most valuable crop of this island. The heavy shade of coffee is so dense, however, that the plant rarely blooms in the dimness beneath unless the branches are trimmed. Therefore, toward the end of the year, the trees on which the vanilla is grown are pruned away. This gives the vanilla plant more light and this induces it to bloom during the ensuing dry season, and also keep the supporting plant from losing all its leaves, which it would normally do at this time.

Pollination of the vanilla orchid is done by hand, usually with a small piece of wood or safety pin, and the flower almost immediately wilts. Only self-pollination is practised, as cross-pollination would be too slow. An experienced girl can pollinate more than six hundred flowers from sunrise to noon, when the flowers are fresh. The temptation to pollinate too many flowers on a young plant weakens the plant and renders it liable to disease. Almost every peasant has lost a good part of his original plants in this way. Seldom is a naturally pollinated bean found, nor is it found in Mexico, the original home of the species.

In a few months the pods attain a length of eight inches or more, but they do not ripen until eight or nine months later.

In order to prevent theft or, as it is called in Dominica, " praedial larceny ", no beans may be plucked before January 15, and many growers brand their beans by writing their initials with a pin on one side of the pod, thus making an indelible scar.

The considerable amount of personal care needed for cultivation prevents this crop from becoming a large-scale estate crop and will tend to keep it in the hands of peasants. This is also true in Mexico where the Tatonoco Indians near Vera Cruz care for the vine on small holdings averaging five acres. Although some peasants attempt to cure their own beans, the best results are obtained by curing on a large scale. The local Dominica Vanilla Growers Association sorts the beans for quality and scalds them in hot water for a few seconds and then places them in small boxes covered with woollen blankets. In a day or two the beans begin to sweat from the heat generated by their own enzyme activity. They are then placed in the sun to dry. Later, when they have

reached one-fifth of their original weight, they are conditioned in boxes. No aroma appears until the conditioning process, which lasts several months, has fairly well begun.

Vanillin, one of the principal constituents of vanilla, is also made from the waste pulp of paper mills in Canada and northern United States, but this is by no means the only ingredient of cured vanilla, which has a mellow, rich flavour—a blend of several unknown ingredients in addition to vanillin.

More than a million pounds of beans normally go to the United States, mostly to flavour ice-cream. Although the price is high, close to eight dollars a pound now, the amount used to flavour ice-cream is so small that the cost of flavouring with real vanilla is only about ten cents a gallon, and in spite of the production of thousands of pounds of artificial vannillin the market for natural vanilla continues. The economic life of Dominica depends on public preference for the real vanilla flavour, which fortunately is a well established habit in the U.S.A.

The cured seed-pod of this pretty orchid, grown in such out-of-the-way coastal regions as those of Mexico, Madagascar, and Dominica, provides the supply of this flavouring to the rest of the world. Vanilla can grow in many parts of the world, but only near the sea and between the latitudes of 10° and 20° north and south has it been found to flourish. If we add to these requirements those of steeply sloping land, a heavy rainfall, and a predominantly peasant proprietor, it is easy to see why Dominica is one of the very few places in the world where vanilla will probably continue to become more important because of large undeveloped areas.

In Dominica the best supporting tree for vanilla vines seems to be hibiscus. It is very difficult to see the succulent green leaves and stems in the shade of the support tree, and equally difficult to see the long green beans in the heavy foliage. A vanilla plantation, to a casual observer, looks like an abandoned clearing in the forest, and some of the most valuable crop land in the world, producing over a thousand dollars per acre, looks completely worthless.

There are other forms of vanilla, some three or four, which grow wild in the island, but none has become of any importance.

Vanilla is the only orchid cultivated for anything except its flower.

[Leo H. Narodny. Journal of the New York Botanical Garden, February 1947.]

COLONIAL LAND POLICY
(A REVIEW)
"LAND LAW AND CUSTOM IN THE COLONIES"

By Dr. C. K. Meek. Pp. xxvi +338 (London, New York and Toronto: Oxford University Press, 1946.) 21s. net.

Dr. Meek has surveyed the bewildering diversity of the Colonial Empire, described the special circumstances and legislation of a number of different territories, and underlined the main issues in a book which will be invaluable to administrators and sociologists alike.

The problems of present day policy arise from the changes that are taking place in the customary forms of land tenure with a change from a substance to a money economy. He urges the need to provide agricultural credit on a sound basis as an essential supplement to legislation aiming to protect land and its produce from alienation for debt.

Several African Governments have made provision for grants of land to individual native farmers who find tribal systems inimical to the adoption of new methods. The most satisfactory type of occupancy is described by Lord Hailey in the introduction.

Dr. Meek's book shows how widespread these problems are. He finds the happiest answer to a number of typical questions in the 1940 Native Land Trust Ordinance of Fiji. This provides for the grant of private rights but makes them subordinate to the needs of rural development and the maintenance of soil fertility. It empowers the Government to intervene not only if a native group is in danger of alienating more land than it can afford but also if it is withholding land from beneficial use, and provides for the redistribution of land in accordance with changes in the population of landowning groups.

Lucy Mair in *Nature*, December 21, 1946, Vol. 158, p. 893.

STAFF NOTES

Mr. R. T. Nesbitt was appointed Meat Inspector and arrived in the Colony and assumed duty with effect from 3rd July, 1947.

Miss M. Garland-Matthews who has been a member of the Staff of the Department of Agriculture for many years and who has for the past year carried out the duties of Assistant Editor of this Journal and Librarian, was granted 36 days leave prior to resignation with effect from 16th August, 1947. Miss Matthews was married to Mr. M. O'Connor on 20th August, and left the Department with the best wishes and congratulations of the Staff.

Mr. T. P. Gardiner was promoted to be Senior Livestock Officer with effect from 1st August, 1947.

Mr. H. J. Hulek was promoted to the post of Office Superintendent with effect from 1st January, 1947.

Mr. C. H. Köster was promoted to be Senior Meat Inspector with effect from 1st August, 1947.

Mr. M. A. Hussein was appointed as a Junior Clerk, Department of Agriculture, with effect from 1st August, 1947.

Mr. S. B. Butadroka, Grade III Clerk, was transferred to the Department of Agriculture, with effect from 1st August, 1947.

Mr. B. E. V. Parham was appointed Acting Registrar of Co-operative Societies, with effect from 1st September, 1947.

Mr. F. E. M. Warner of the Registrar-General's Department was appointed to the post of Marketing Officer with effect from 1st September, 1947, and seconded to the Registrar-General's Department from the same date.

Mr. L. E. Smythe, Chemist, appointed with effect from 1st May, 1947; arrived in the Colony and assumed duty on 20th July, 1947.